My First Medical Writing

SECTION EDITOR

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Editorial

After a short break, this section is back to highlight the work of new and aspiring medical writers. For this issue, I had the pleasure of working with Micko Calizon on his article about the role of AI in HIV detection and AIDS prevention. Micko is an aspiring medical writer with a Master's in Biomedical Sciences from the University of the West of England. Throughout his academic journey, he enjoyed translating scientific data and literature into digestible content, from conference posters to journal manuscripts. Since graduation, he has explored different career opportunities within medical communications to develop his writing and comprehension skills. He is now excited to find his niche within the industry and this article is one of his first key milestones. I hope you enjoy this read! **Evguenia**

Could AI play a key role in the fight against HIV/AIDS?

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doi: 10.56012/avjy7101

Since its discovery in 1983, human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) has been a recognised global public health issue. However, what was once considered an incurable disease is becoming increasingly treatable and manageable. Interventions for HIV/AIDS such as pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) have been developed to minimise the risk of HIV transmission before and following sexual intercourse. Additionally, antiretroviral therapies (ARTs) suppress viral replication within cells, lessening viral load and improving the quality of life for HIV patients.[1] Novel technologies such as artificial intelligence (AI) and machine learning (ML) have shown promise in aiding initiatives aimed at HIV prevention and management. Could AI be the next key player in the fight against HIV/AIDS?

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HIV screening and diagnosis

AI has been used to identify individuals at risk of HIV in countries like Ukraine, which has one of the highest increases in HIV/AIDS cases outside of Africa.[2] Following the declaration of the Russia-Ukraine war, fears of an increase in HIV cases arose due to potential disruptions in case finding and accessible healthcare. To combat this potential risk, The Alliance for Public Health, an HIV advocacy organisation within Ukraine, used ML algorithms to increase HIV screening. For example, they utilised a ML model that used data from screening questionnaires to identify people at risk of HIV within an HIV-positive person's network. The model demonstrated a 37% better ability in HIV case detection than non-ML methods, with a recorded 5.2% HIV detection rate.[3] Data from this study was used by the government to successfully recruit individuals believed to be at risk of contracting HIV.

A similar model was used in Kenya and Uganda where ML methods identified candidates at risk of contracting HIV. The Sustainable East Africa Research in Community Health (SEARCH) study is a research programme investigating the impact of early HIV diagnosis and ART treatment on rural communities in East Africa. Researchers within the study used data from 16

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communities within Uganda and Kenya to create an algorithm-generated risk score that identified high-risk individuals. ML was more sensitive than other methods, correctly identifying 78% of seroconversions (where the body starts producing detectable levels of HIV antibodies) compared to 58% with risk-group strategies and 68% with a model-based strategy. ML methods were also more efficient, targeting 18% of the population while the risk-group strategy targeted 42% and the model-based strategy targeted 27% of the population to achieve the same result.[4]

Roles surrounding treatment

In Africa, AI algorithms have been used to accelerate the distribution process of essential medications managed by supply chains. In Kenya and Tanzania, traditional methods of predicting treatment demands are typically time-consuming and at risk of inaccuracies. An East African health firm called inSupply Health integrated predictive ML models into supply chain systems to improve the accuracy of forecasting the need for medications. These models significantly accelerated distribution calculations of supply chains within Kenya and Tanzania, reducing the time taken to generate medication forecasts from 3 days to 15 minutes and 3 weeks to 1 day, respectively.[5] These methods could be applied to the management of HIV medications such as ARTs or PrEP to streamline their distribution.

Different ML algorithms can be used to predict the likelihood of events. Logistic regression algorithms estimate the probability of a binary result, such as a "positive" or "negative".[6] One such algorithm was used to create predictive tools to detect viral nonsuppression in HIV-positive people who received at least one year of HIV care. This tool was successful in identifying variables that predicted the outcome of HIV treatment and can be used to triage those requiring more intensive care. The model was also found to possess good discriminative performance to distinguish between classified groups.[7]

> However, it is important to remember that AI is not faultless and should not replace human-led techniques.

Limitations of AI

AI is a promising tool for improving HIV diagnostic regimens and speeding up processing operations, but there are still some challenges to face before AI models can be widely implemented. Studies on AI techniques are still in their infancy with many studies only focusing on AI in HIV prevention and treatment and less on topics such as finding a cure. Most of these studies also use more basic or conventional ML models rather than recent, more advanced ones. A potential reason for this is the multidisciplinary approach that typically involves researchers within HIV, health professionals, and programmers.[8] The more advanced AI algorithms need to be customised to particular problems or populations which can be time-consuming, costly, and requires optimisation.

Furthermore, there are still concerns surrounding the privacy, security, and ownership of data used by AI as the algorithms generally require large amounts of data to operate. It may not always be possible to trace the source of data to determine if it was obtained ethically or not, especially when using extensive datasets.

Ensuring the data was obtained legally and with permission from participants is crucial when handling sensitive data such as a patient's HIV status. Also, the potential for bias exists (particularly if data from a particular group is limited) as algorithms learn from a given dataset and may not be able to detect any biases within the data. As a result, certain demographics may be underrepresented, for example, and results may not be fair, questioning the reliability of data.[9]

The future of AI research

AI and ML show great promise in advancing current research around HIV prevention and treatment. Machine-led techniques can significantly reduce processing times, reduce the possibility of human error, and correctly identify certain characteristics or variables within data. However, it is important to remember that AI is not faultless and should not replace human-led techniques. Instead, it seems AI is best used in conjunction with human supervision to aid current research rather than relying solely on it. As AI's role within science continues to be explored, there could be many uncovered possibilities. Studies have yet to use AI in finding a cure for HIV, which would take us one step closer to eradicating HIV/AIDS.

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